Sanitising and covering large medical imaging equipment

Rapid review questions

1. Which method is most effective in sanitising large medical imaging equipment for COVID-19?
2. Which method is most effective in covering or protecting large medical imaging equipment for COVID-19?
3. Which method is most effective in sanitising linear accelerators and radiotherapy bunkers for COVID-19?

In brief

Sanitising large medical equipment

- There is a variety of options for disinfectants to use on medical imaging equipment. Most guidelines suggest compliance with equipment vendor guidance to find the safest disinfectant for each piece of equipment.
- Regulatory agencies (such as the Therapeutic Goods Agency) publish lists of approved disinfectants (Table 4).
- Expert consensus-based guidance suggest:
  - 60 minute down-time followed by cleaning protocol with approved cleaning agents, following a clockwise, linear, and top to bottom pattern for cleaning all visible surfaces.
  - Sanitisation needs to include adequate cleaning of radiological instruments, particularly the detectors and of the protective equipment used by parents or carers.
  - CT examination rooms are disinfected according to regulations and air disinfection is conducted for 30 minutes before examining other patients.
- Specific disinfectants for machines during COVID-19 have included: isopropyl alcohol 70%, diluted bleach solution (6mg chlorine releasing disinfectant tablet to 1,000ml water), 2,000mg/L chlorine-containing disinfectant; 500 to 1,000mg/L chlorine containing disinfectant; and alcohol-containing disposable disinfectant wipes.
- Medical imaging machine manufacturers state that using cleaning agents that have not been evaluated or have not passed material compatibility testing could have an unknown or harmful impact if used on device surfaces. Impacts may include degrading cosmetic or functional performance, damaging device surfaces or labels, causing immediate equipment failure or even causing longer term latent failures.
- The Australian Commission on Safety and Quality in Healthcare guidelines recommend that shared equipment should be cleaned with a detergent solution after each use with cleaning
agents compatible with the piece of equipment being cleaned, as per manufacturer instructions. The Clinical Excellence Commission recommend cleaning and disinfection for environmental cleaning during COVID-19.

Covering or protecting large medical equipment

- There is limited evidence and the small amount of evidence available is contradictory around covering or protecting medical imaging equipment.
- Semi-permeable gowns or drapes have been recommended over plastic coverings, as plastics could potentially damage the machines due to a risk of overheating.
- Recommendations for using plastic covers are specifically for detectors, scan couches and detectors. However, use of plastic coverings for some machine components could also result in suboptimal images and prolongation of scan time.

Sanitising linear accelerators and radiotherapy bunkers

- There are some options for disinfectants to use on linear accelerators. Most guidelines suggest compliance with equipment vendor guidance to find the safest disinfectant for each piece of equipment in use. Manufacturer guidance includes guidance on sanitisation of their machines, noting that not every type of disinfectant can be applied to every component of the equipment.
- There was no published guidance or research evidence for sanitising radiotherapy bunkers.
- This rapid review does not consider in-room disinfecting systems, such as ozone or any type of misters, which are used to prevent damage to ‘linac’ (linear accelerator) machines.

Limitations

- There is a lack of research on the best sanitising method for large medical imaging equipment.
- Sanitisation methods are dictated by the type of equipment, equipment parts and materials being cleaned and also the list of manufacturer-tested and approved disinfectants. Some guidelines defer back to using regulatory agency lists of approved disinfectants.
- It is unclear how using non-company approved disinfectants may affect or damage the performance of machines, the materials of the machines and manufacturer warranties. Companies may not have tested regulator-approved disinfectants on their machines yet, particularly for use against COVID-19.
- This rapid review does not consider in-room disinfecting systems, such as ozone or any type of misters, which are used to prevent damage to ‘linac’ machines.

Background

There are varying infection control policies for COVID-19 between institutions and clinics. It is unclear what the best practices are for sanitising and protecting medical imaging equipment. In general, there are a few types of disinfectants: isopropyl alcohol, enzymatic cleaners, mild cleaners, diluted bleach, and mineral spirits. When considering medical imaging equipment, it is necessary to consider the various equipment parts and materials to be cleaned. For example, the recommended cleaning solutions for a CT machine differs for the control console, couch covers and bellows, couch runners, painted sheet metal, couch top, camera mount, touch screen, motion control buttons, bore, covers, phantoms and crosshairs. Individual companies also publish disinfection guides and cleaning procedures.
The Australian Commission on Safety and Quality in Healthcare guidelines for the prevention and control of infection in healthcare outline practical information for shared clinical equipment. Shared equipment should be cleaned with a detergent solution after each use with cleaning agents compatible with the piece of equipment, as per manufacturer instructions.

The Clinical Excellence Commission recommends cleaning and disinfection for environmental cleaning during COVID-19. Key principles include using a detergent and using a disinfectant.

**Methods**

Databases and grey literature sources were searched on 29 and 30 April 2020.

**Results** (Tables 1 – 4)
Table 1: Sanitising large medical imaging equipment

<table>
<thead>
<tr>
<th>Title</th>
<th>Summary</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer reviewed literature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Goh, et al. 2020                                                      | ● Surfaces are wiped down with isopropyl alcohol 70%.  
● Terminal cleaning of the scan room by housekeeping staff is also carried out by using diluted bleach solution (6mg chlorine releasing disinfectant tablet to 1,000ml water) to wipe down the machine, walls and floor.  
● Because there is no negative air pressure room, the CT scanner and the scan room is aired for at least 30 minutes to allow the cleaned surfaces to dry adequately before proceeding to scan another patient.  
● For portable X-ray machines, deep cleaning is performed twice a day using diluted bleach solution to wipe down the machine’s exterior.  
● For parts of the machine that are delicate (e.g., collimators, control console, exposure buttons), isopropyl alcohol 70% rather than bleach is used for cleaning after every patient.  
● For detailed guidelines on equipment disinfection, staff should seek advice from their specific equipment vendors. | https://www.jacr.org/article/S1546-1440(20)30306-9/fulltext                                                                                     |
| Huang, et al. 2020                                                    | ● General disinfection procedure:  
○ The floor and equipment in the CT examination room are disinfected according to regulations and air disinfection is conducted for 30 minutes before examining other patients. These CT scanners are considered non-contaminated (not fever-CTs) after these sterilisation procedures.  
● Equipment disinfection:  
○ The equipment in the contaminated area is wiped with 2,000mg/L chlorine-containing disinfectant. The DR and CT gantry in contaminated areas are wiped with 75% ethanol. The equipment in the buffer area is wiped with 500 to 1,000mg/L chlorine containing disinfectant or alcohol-containing disposable disinfectant wipes twice a day.  
● Fever-CT disinfection procedures:  
○ After Examination, in addition to the previous procedures, the examination bed and the ground is disinfected with 2,000mg/L chlorinated disinfectant. | https://www.sciencedirect.com/science/article/pii/S1546144020302854?via%3Dihub                                                               |
<table>
<thead>
<tr>
<th>Title</th>
<th>Summary</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peer reviewed literature</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kooraki, et al. 2020</td>
<td>• Radiology departments should contact their equipment vendors to find the safest disinfectant for each piece of equipment.</td>
<td><a href="https://www.jacr.org/article/S1546-1440(20)30150-2/fulltext">https://www.jacr.org/article/S1546-1440(20)30150-2/fulltext</a></td>
</tr>
</tbody>
</table>
| Mossa-Basha, et al. 2020 | • CT equipment may be out of commission for several hours for cleaning.  
• The room is cleaned and disinfected according to hospital protocols. | [https://pubs.rsna.org/doi/10.1148/radiol.2020200988](https://pubs.rsna.org/doi/10.1148/radiol.2020200988) |
| **Grey literature** | | |
| American College of Radiology, 2020, CR Guidance on COVID-19 and MR Use (8 April 2020) | • MR room cleaning and disinfecting protocols are quite varied and are subject to change with the unique clinical circumstances of that particular site (e.g., availability of PPE, emergent need for truly immediate access to the only available but not yet disinfected MR scanner for a non-COVID-19 patient, etc.).  
• General guidelines exist, such as 60 minute down-time followed by cleaning protocol with approved cleaning agents using a clockwise, linear, top to bottom pattern of cleaning all visible surfaces. However, these will be tempered by local guidelines and policies and especially the specific clinical needs of the patients and the site, and are likely to change over time. | [https://www.acr.org/Advocacy-and-Economics/Advocacy-News/Advocacy-News-Issues/In-the-April-4-2020-Issue/ACR-Information-on-Field-Radiology-Care-During-the-COVID-19-Pandemic](https://www.acr.org/Advocacy-and-Economics/Advocacy-News/Advocacy-News-Issues/In-the-April-4-2020-Issue/ACR-Information-on-Field-Radiology-Care-During-the-COVID-19-Pandemic) |
| American Institute for Ultrasound Medicine, 2020, Guidelines for Cleaning and Preparing External- | • Changes due to COVID-19 outbreak:  
  o Level of disinfection for external and interventional procedures, low-level disinfection is effective as per CDC guidelines.  
  o Currently, EPA approved disinfectants for use against COVID-19 (SARS-CoV-2) can be found online. | [https://www.aium.org/officialStatements/57](https://www.aium.org/officialStatements/57) |
<table>
<thead>
<tr>
<th>Title</th>
<th>Summary</th>
<th>Link</th>
</tr>
</thead>
</table>
| and Internal-Use Ultrasound Transducers and Equipment Between Patients as well as Safe Handling and Use of Ultrasound Coupling Gel | o If LLD agents are depleted soap and water should be used per CDC guidelines.  
  o If indicated but no transducer covers are available, medical gloves or other physical barriers (e.g. compatible medical dressings) should be used.  
  • Education and execution:  
    o Dissemination of cleaning guidelines is essential and so is their proper execution.  
  • Equipment:  
    o Cleaning involves all ancillary equipment involved in the procedure at hand.  
    o A cover sheet may be used as a physical barrier between the keyboard/console and the operator, in addition to LLD cleaning.  
    o If possible, use a dedicated system (scanner and transducers) for COVID-19 positive or suspected patients.  
    o COVID-19 is viable on plastic surfaces for up to 72 hours.  
    o Special attention needs to be paid to COVID-19 and other respiratory infection cases requiring aerosolisation procedures, i.e. mechanical ventilation, aerosolisation application, etc. Here a transducer cover should be used and the entire equipment requires full LLD (top to bottom) as pathogens are likely to become airborne.  
    o Always follow manufacturer guidance and institutional guidelines. |  |
| American Society of Echocardiography, 2020, ASE Statement on COVID-19 (1 April 2020) | • Although SARS-CoV-2 is sensitive to most standard viricidal disinfectant solutions, care must be taken when cleaning.  
  • Local standards vary but echocardiogram machines and probes should be thoroughly cleaned, ideally in the patient’s room and again in the hallway.  
  • Smaller, laptop-sized portable machines are more easily cleaned, but use of these machines should be balanced against potential trade-offs in image quality and functionality.  
  • Please consult vendors’ disinfecting guidelines, which are available on their websites, as procedures vary and could affect the functionality of machines.  
  • TEE probes should undergo cleaning in the room (including the handle and cord), then be transferred in a closed container to be immediately disinfected according to the manufacturer’s recommendations. The exact steps to be followed for disinfection of the TEE probe and equipment will depend on local institutional protocols that usually are guided by infectious disease experts and resource availability. | https://www.asecho.org/ase-statement-covid-19/ |
<table>
<thead>
<tr>
<th><strong>Title</strong></th>
<th><strong>Summary</strong></th>
<th><strong>Link</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Society for Cardiovascular Magnetic Resonance, 2020, SCMR’s COVID-19 Preparedness Toolkit (as of 25 March 2020)</td>
<td>• Clean technologist should use the appropriate protocol in your institution to decontaminate the surfaces of the equipment and surrounding environment. • Follow manufacturer specific guidance on how to clean the scanner.</td>
<td><a href="https://scmr.org/page/COVID19">https://scmr.org/page/COVID19</a></td>
</tr>
</tbody>
</table>
Table 2: Coverings for large medical imaging equipment

<table>
<thead>
<tr>
<th>Title</th>
<th>Summary</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goh et al. 2020</td>
<td>Single-use disposable plastic sheets are used for lining of CT scan couches for case suspects.</td>
<td><a href="https://www.jacr.org/article/S1546-1440(20)30306-9/fulltext">https://www.jacr.org/article/S1546-1440(20)30306-9/fulltext</a></td>
</tr>
</tbody>
</table>

USA Centers for Disease Control and Prevention, 2020. Interim Infection Prevention and Control Recommendations for Patients with Suspected or Confirmed Coronavirus Disease 2019 (COVID-19) in Healthcare Settings

- Dedicated medical equipment should be used when caring for patients with known or suspected COVID-19.
- All non-dedicated, non-disposable medical equipment used for patient care should be cleaned and disinfected according to manufacturer’s instructions and facility policies.

<table>
<thead>
<tr>
<th>Title</th>
<th>Summary</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peer reviewed literature</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| American Society of Echocardiography, 2020, ASE Statement on COVID-19 (1 April 2020) | • Some institutions cover probes and machine consoles with disposable plastic and forego the use of ECG stickers. It is important to note that the benefit of using protective covers must be balanced against the risk of potential for suboptimal images and prolongation of scan time.  
• Some institutions set aside certain machines or probes for use on patients with suspected or confirmed infection. | [https://www.asecho.org/ase-statement-covid-19/](https://www.asecho.org/ase-statement-covid-19/)                                                                                     |
| American College of Radiology, 2020, ACR Information on Field Radiology Care During the COVID-19 Pandemic (2 April 2020) | • Separate the X-ray tube from the patient with plexiglass in order to simplify terminal cleaning.  
| GE Healthcare. COVID-19 Homepage > Frequently Asked Questions > Cleaning and Disinfection | • Question 18: Can I wrap the medical device in plastic to reduce possible contamination?  
Answer: No. The plastic will trap air and reduce airflow and possibly lead to overheating of electronic devices, which may lead to loss of function (e.g. imaging during a procedure). Some devices (e.g. ultrasound systems, patient tables etc.) could be wrapped in semi-permeable gowns or drapes, or custom coverings/drapes, which could provide added protection against large droplets or contamination. | [https://www.gehealthcare.com/corporate/covid-19-faq-cleaning-and-disinfection](https://www.gehealthcare.com/corporate/covid-19-faq-cleaning-and-disinfection) |
Recent research suggests SARS-CoV-2 (coronavirus causing COVID-19) can persist on steel and plastic surfaces for up to 72 hours, reinforcing the need for appropriate barrier precaution (e.g., detector covers).

Table 3: General equipment disinfection guidelines

<table>
<thead>
<tr>
<th>Title</th>
<th>Summary</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peer reviewed literature</strong></td>
<td></td>
<td>COVID-19-health-emergency.pdf</td>
</tr>
<tr>
<td><strong>Grey literature</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>USA Centers for Disease Control and Prevention</strong></td>
<td>• CDC provides general guidance for cleaning and disinfecting equipment and facilities.</td>
<td><a href="https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/cleaning-disinfection.html">https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/cleaning-disinfection.html</a></td>
</tr>
<tr>
<td><strong>USA Environmental Protection Agency</strong></td>
<td>• US EPA provides a list of disinfectants for use against COVID-19.</td>
<td><a href="https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2">https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2</a></td>
</tr>
<tr>
<td><strong>European Centre for Disease Prevention and Control</strong></td>
<td>• European Centre for Disease Prevention and Control has a technical report on 'Disinfection of environments in healthcare and non-healthcare setting potentially contaminated with SARS-CoV-2'. • This provides generic advice on disinfecting various surfaces and environments.</td>
<td><a href="https://www.ecdc.europa.eu/sites/default/files/documents/Environmental-persistence-of-SARS_CoV_2-virus-Options-for-cleaning2020-03-26_0.pdf">https://www.ecdc.europa.eu/sites/default/files/documents/Environmental-persistence-of-SARS_CoV_2-virus-Options-for-cleaning2020-03-26_0.pdf</a></td>
</tr>
<tr>
<td>Title</td>
<td>Summary</td>
<td>Link</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Grey literature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4: Disinfectants for use against COVID-19 included in the ARTG for legal supply in Australia

<table>
<thead>
<tr>
<th>Product name</th>
<th>Manufacturer</th>
<th>ARTG ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clorox disinfecting wipes</td>
<td>The Clorox Company</td>
<td>333208</td>
</tr>
<tr>
<td>Fuzion</td>
<td>The Clorox Company</td>
<td>332716</td>
</tr>
<tr>
<td>Germicidal Wipes</td>
<td>The Clorox Company</td>
<td>335509</td>
</tr>
<tr>
<td>Total 360</td>
<td>The Clorox Company</td>
<td>332715</td>
</tr>
<tr>
<td>Oxivir FIVE16</td>
<td>Virox Technologies Inc</td>
<td>286618</td>
</tr>
<tr>
<td>Oxivir Tb</td>
<td>Virox Technologies Inc</td>
<td>165058</td>
</tr>
<tr>
<td>Oxivir Tb Wipes</td>
<td>Virox Technologies Inc</td>
<td>164850</td>
</tr>
<tr>
<td>Taskforce Commercial Grade Disinfectant</td>
<td>Custom Chemicals International Pty Ltd</td>
<td>334780</td>
</tr>
<tr>
<td>Trigene Advance Concentrates / Sterigene Concentrates</td>
<td>Tristel Solutions Limited (United Kingdom)</td>
<td>232937</td>
</tr>
<tr>
<td>Trigene Advance Solution / Sterigene Solution</td>
<td>Tristel Solutions Limited (United Kingdom)</td>
<td>233129</td>
</tr>
<tr>
<td>Virex II (J-flex / J-Fill)</td>
<td>Virox Technologies Inc</td>
<td>153031</td>
</tr>
<tr>
<td>Whiteley Industries Viraclean</td>
<td>Whiteley Corporation Pty Ltd t/a Whiteley Medical</td>
<td>69000</td>
</tr>
<tr>
<td>Zoono Z-71 Germkiller</td>
<td>Elitepac Ltd</td>
<td>224480</td>
</tr>
</tbody>
</table>

Appendix 1

Search Terms

Population / condition search terms:


Intervention search terms:

Sanitation OR sanitise OR sanitize OR disinfect OR clean OR cover OR protect OR lining OR wrap

Searched Resources:

Databases: PubMed; TRIP Database

General search: Google.

Australian Sources:

- Australian Government Therapeutic Goods Administration
- Australian Government Department of Health
- Royal Australian and New Zealand College of Radiologists

Other Sources (e.g. regulators, peak bodies, and organisations):

- North America:
  - Centers for Disease Control and Prevention
  - Food and Drug Administration
  - Environmental Protection Agency
  - American College of Radiology
  - American Institute for Ultrasound in Medicine
  - American Society for Echocardiography

- Europe:
  - UK Medicines and Healthcare Products Regulatory Agency
  - European Centre for Disease Prevention and Control
  - Public Health England
  - Italian Society of Medical and Interventional Radiology / Italian College of Paediatric Radiology

- International
  - World Health Organisation
  - Society for Cardiovascular Magnetic Resonance

Companies:

- Canon/Toshiba
- GE Healthcare
- Philips
- Siemens Healthineers
- Varian

Rapid evidence checks are based on a simplified review method and may not be entirely exhaustive, but aim to provide a balanced assessment of what is already known about a specific problem or issue. This brief has not been peer-reviewed and should not be a substitute for individual clinical judgement, nor is it an endorsed position of NSW Health.
References

- American Institute for Ultrasound Medicine, 2020, Guidelines for Cleaning and Preparing External- and Internal-Use Ultrasound Transducers and Equipment Between Patients as well as Safe Handling and Use of Ultrasound Coupling Gel. URL: https://www.aium.org/officialStatements/57
- GE Healthcare, 2020, Cleaner compatibility: Cleaner and disinfectant material compatibility. URL: https://cleaning.gehealthcare.com/